FLEXOO | BaMoS
The Battery Monitoring Solution for R&D

Battery Monitoring Solution

FLEXOO GmbH
an InnovationLab company

BaMoS – Battery Monitoring Solution

Acquiring meaningful data is the foundation for improvement. Often, however, this data is just not accessible.

This is the case for rechargeable batteries. We don't really know what is happening within a battery system during charging cycles and stress tests in terms of **pressure** and **temperature distribution**.

How can a measure of improvement be defined without properly understanding the system?

1. Measure

3. Improve

2. Understand
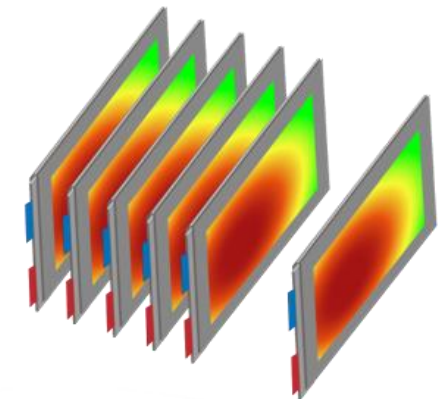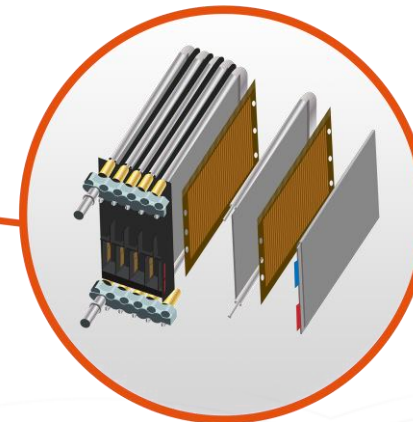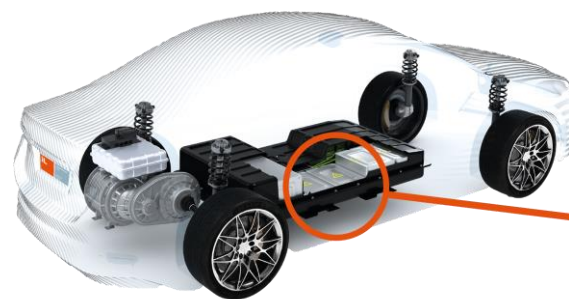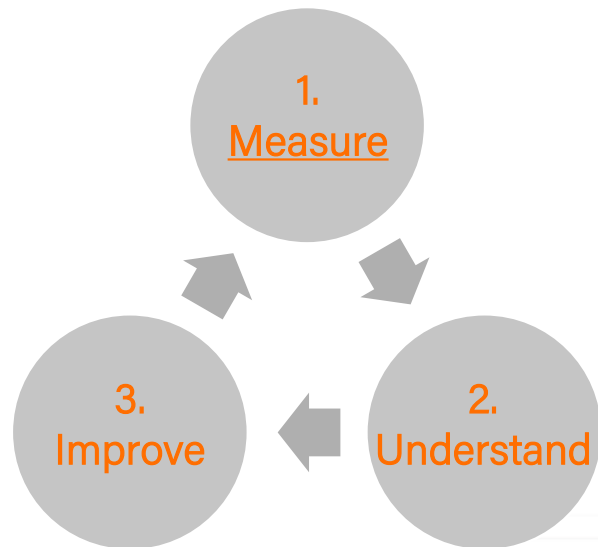
How to Measure Inside a Battery System

Thin foil sensors can be placed between the cells and thus solve this issue.

An example:

During the charge/discharge cycle, batteries undergo continuous volume and temperature changes. These changes aren't uniform. The only way to capture them is by using foil sensors.

This allows to...

✓ measure the state of charge (SoC) directly,
✓ implement preload and cell balancing measures,
✓ detect irregular behavior,
✓ prevent overcharging,
✓ and gain information on state of health (SoH)

**Foil sensors enable getting data from inside of the battery system.
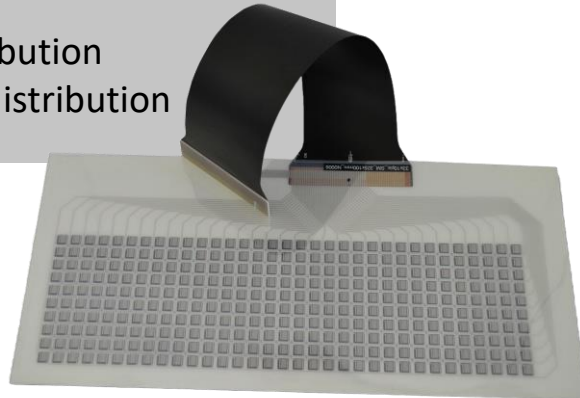Both spatially & temporally resolved.**
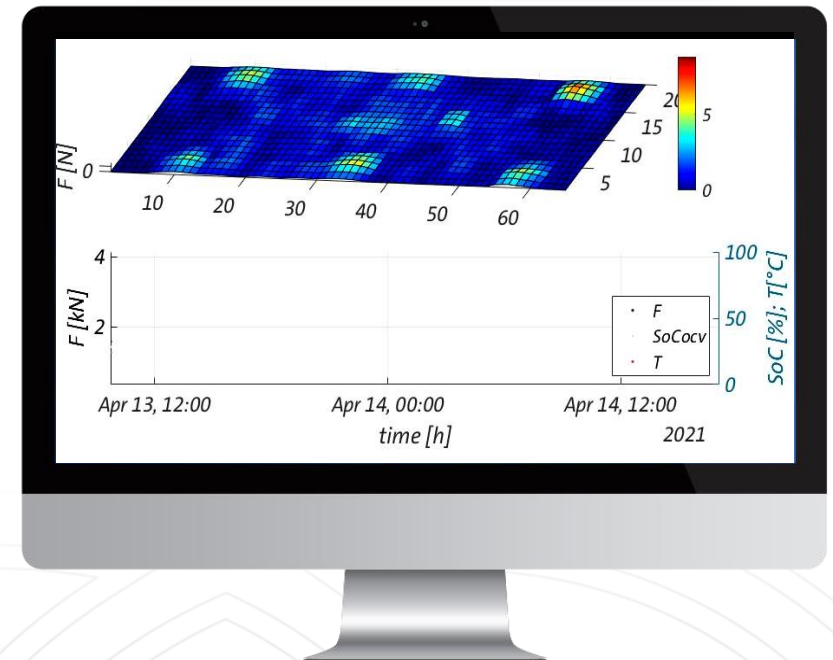
Battery Monitoring Solution overview

FLEX○○

1. Sensor Foils:

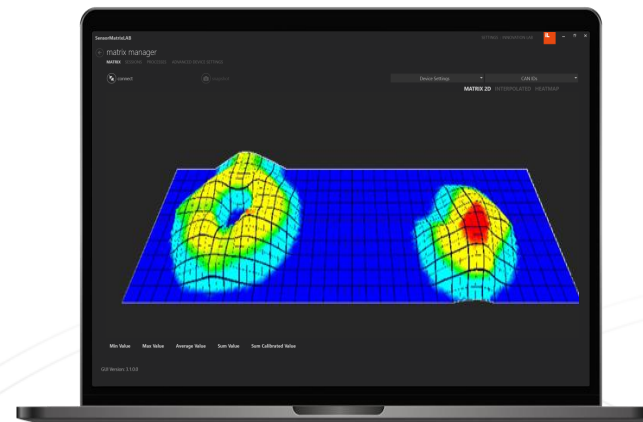- Pressure distribution
- Temperature distribution

2. Read-out Electronics:

- State-of-the-art with reduced cross-talk
- 12-bit digital resolution
- Electro-magnetic interferrance protection
- Several communication interfaces

3. Software:

- Live 3D/2D data visualization, storage and analysis
- Data filtering
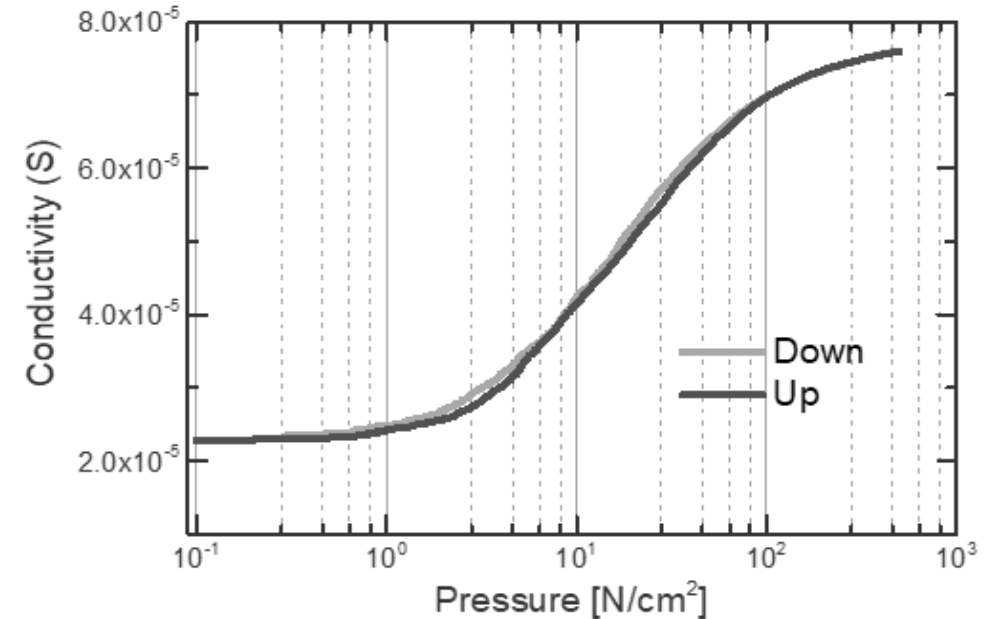- Real-time streaming via API
- Calibration option

Sensor foils for measuring the pressure distribution

FLEX○○

Matrix of printed piezoresistive pixels on thin polyimide substrate.

High Performance (Prime Mode):

Conductivity (S) vs Pressure [N/cm²]

— Down
— Up

Strong performance:
(General values)

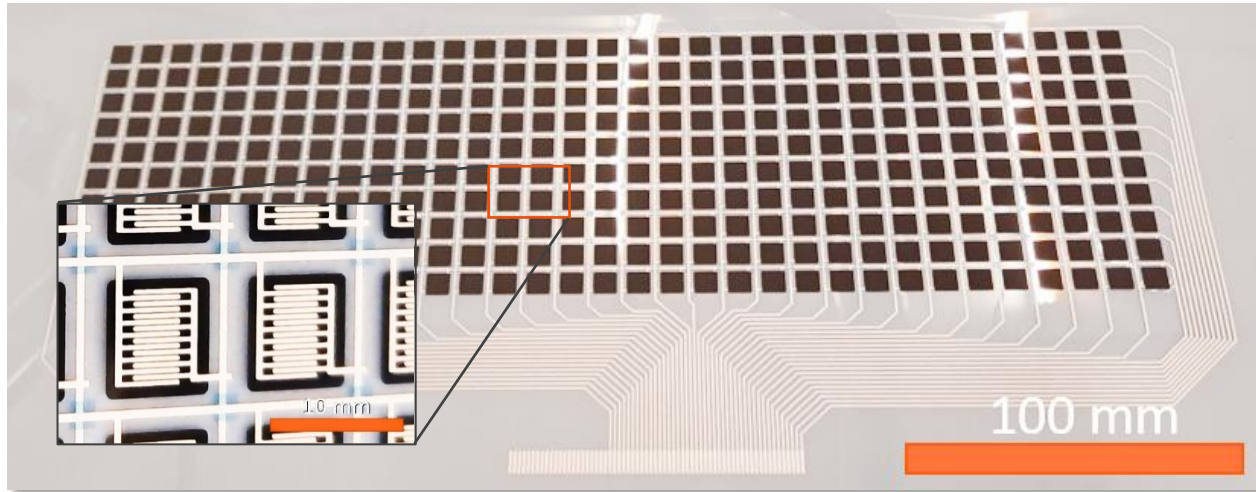|		
✓	Huge measurement range:	0.1 – 500 N/cm²
✓	High repeatability:	0.2% - 5 % (repeatibility error)
✓	High durability:	< 5 % (loss after 1 Mio. Cycles of 150 N/cm² load)
✓	Overall thickness:	110 - 250 μm
✓	Operating Temperature:	-20°C – 100°C

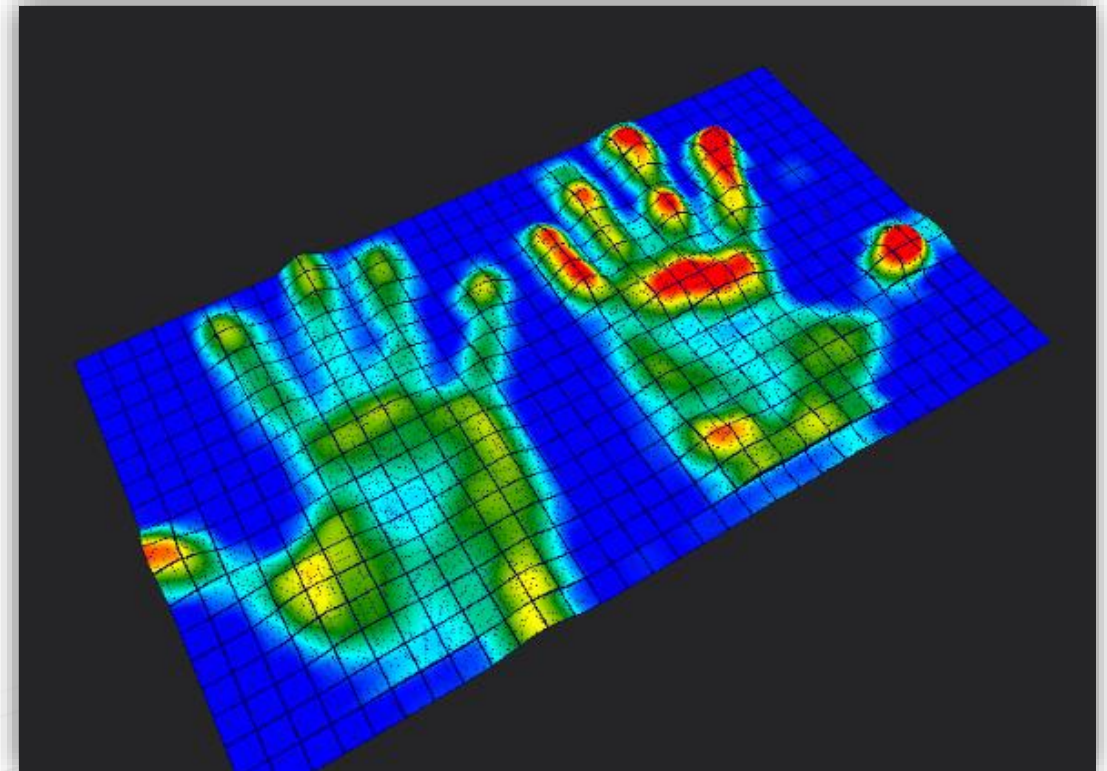# Sensor foils for measuring the pressure distribution

FLEXO

Portfolio:

	Type 1	Type 2	Type 3	Type 4	Type 5	Custom
Measurement Mode	Thru	Thru	Thru	Shunt	Prime	
Resolution (# of pixels)	29 x 17	64 x 20	64 x 20	32 x 10	32 x 10	up to 96×96
Active area (cm²)	15 x 9	33 x 10	53 x 11	32 x 10	32 x 10	up to 40×60
Pixel size (cm²)	0.32×0.32	0.30×0.30	0.50 x 0.32	0.62 x 0.57	0.5 x 0.5	down to 0.01 (Thru) down to 0.2 (Shunt) down to 0.25 (Prime)
Foil material	PI (2 x 50 μm)	PI (2 x 50 μm)	PI (2 x 50 μm)	PET (2 x 75 μm)	PET (2 x 100 μm)	PI, PET, PEN,...
Suitability for • low pressure • high pressure	+ +	+ +	+ +	++ +	++ ++	

6

Sensor foils for measuring the temperature distribution

Temperature-sensitive resistors printed on interdigitated electrode structures enable **spatially resolved temperature measurements** on very thin foils (< 80 μm).
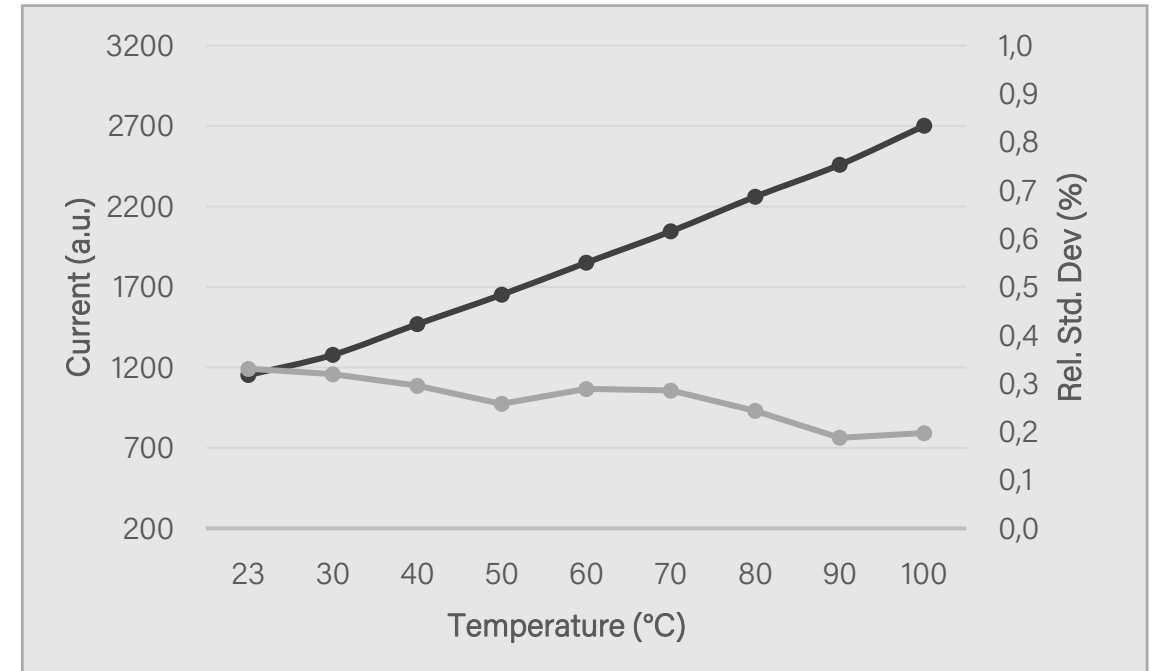

Color-coded image of the temperature distribution induced by a hand.

Sensor foils for measuring the temperature distribution FLEXOO

Portfolio:

	Standard	Custom
Resolution (# of pixels)	32 x 10	up to 96 x 96
Active Area (cm²)	32 x 10	up to 35 x 55
Pixel size (cm²)	0.62 x 0.57	down to 0.2
Foil material	PET (2 x 75 µm)	PI, PET, PEN

Dependency of the measured current on the temperature. A clear linear behavior is observed.

Typical performance:

✓ Highly linear behavior

✓ Accuracy: < 1 °C

✓ Range: 10 - 100 °C and beyond

✓ Pressure independent

Read-out electronics

- High-resolution for matrices with up to 96x96 sensor pixels
- Low noise 12-bit ADC signal
- Protected from electro-magnetic interference
- Strongly reduced crosstalk between pixels
- Typical read-out frequencies of about 100 fps
- Usable for pressure- and temperature-sensitive matrices
- Communication via serial USB, CAN, Ethernet or Wi-Fi

Software: SensorMatrixLAB v5.x

FLEX
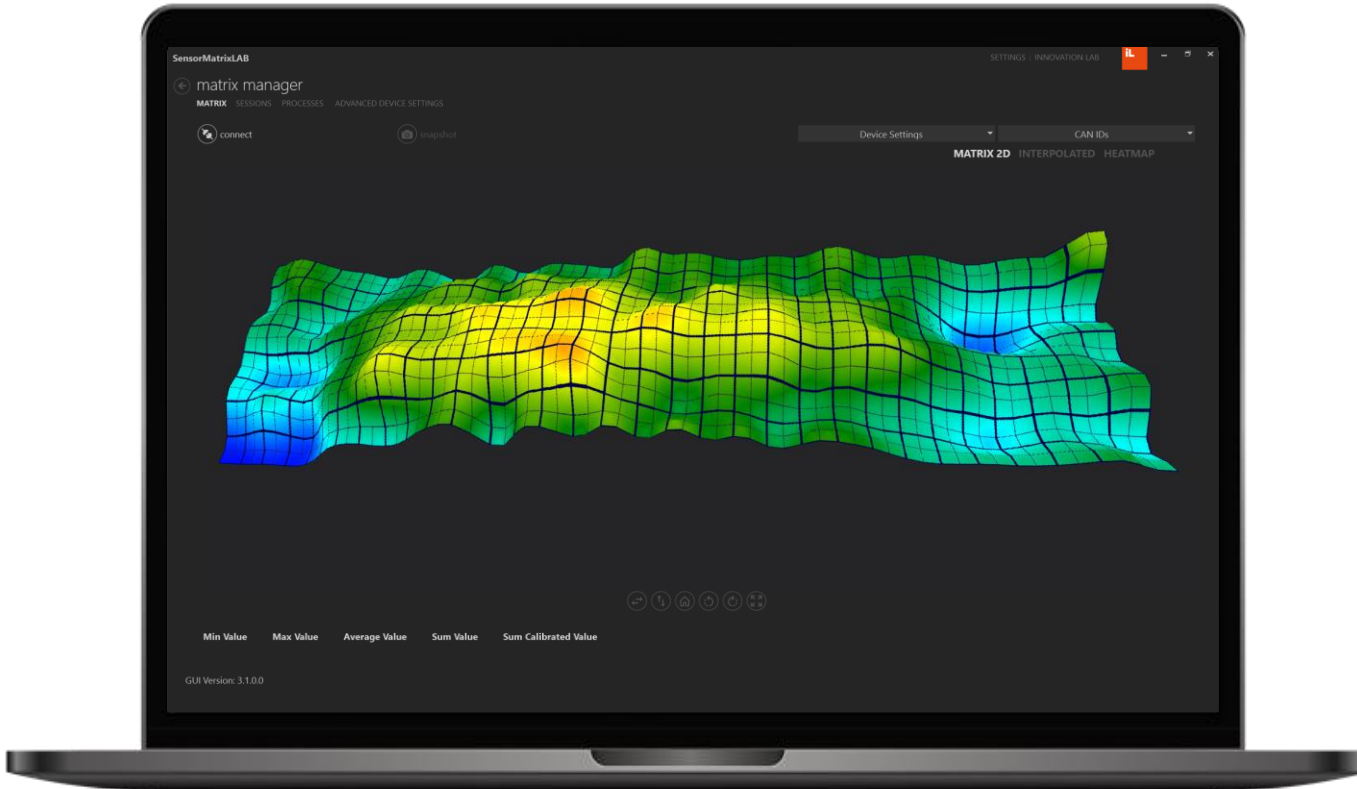
- Advanced 2D & 3D data visualization
- Data recording and replaying
- Real-time streaming via API
- Supports different communication Interfaces
- Multi-matrix real-time readout possibilities
- Support of customized printed sensor matrices
- HDR function: adjustment of measuring range via V_{ref}
- Sensor calibration option

More information at: https://www.flexoo.de/products/sensormatrixlab/

We sense your needs

We specialize in delivering **end-to-end solutions** for smart **sensors** and **electronics** from initial development to final manufacturing.

Our dedicated team takes pride in tackling challenges head-on. Experience firsthand fast and purposeful problem-solving **tailored** to your unique needs.

References

Customers:

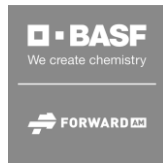
BaMoS in media (click to open link):

Challenge us

FLEXOO

Bart Jarkiewcz
Technical Sales Manager

Lars Keiz
Product Manager Battery Monitoring Solutions

Dr. Florian Ullrich
Head of Business Development

Schedule an appointment